

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

To:
FENSTER & COMPANY,
INTELLECTUAL PROPERTY 2002 LTD.
Attn. Fenster, Paul
P.O. Box 10256
49002 Petach Tikva
ISRAEL

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT AND
THE WRITTEN OPINION OF THE INTERNATIONAL
SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference 032/04081	Date of mailing (day/month/year) 09/11/2005
International application No. PCT/IL2004/001169	International filing date (day/month/year) 26/12/2004
Applicant ALGOTEC SYSTEMS LTD.	

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the International Search Report; however, for more details, see the notes on the accompanying sheet.

Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes
1211 Geneva 20, Switzerland, Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. ☐ **With regard to the protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

- ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.
☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. Reminders

Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90*bis*.1 and 90*bis*.3, respectively, before the completion of the technical preparations for international publication.

The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. These comments would also be made available to the public but not before the expiration of 30 months from the priority date.

Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until **30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months.

See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the *PCT Applicant's Guide*, Volume II, National Chapters and the WIPO Internet site.

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Name and mailing address of the International Searching Authority European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Leila Kuhnen	<div style="text-align: center; border: 2px solid black; padding: 5px;"> RECEIVED Docketed By <u>IK</u> 15 NOV 2005 To: <u>MF</u> <input type="checkbox"/> <u>MK</u> (See notes on accompanying sheet) FENSTER & Co. </div>
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NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the *PCT Applicant's Guide*, a publication of WIPO.

In these Notes, "Article", "Rule", and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions, respectively.

INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report and the written opinion of the International Searching Authority, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only (see *PCT Applicant's Guide*, Annexes B1 and B2).

The attention of the applicant is drawn to the fact that amendments to the claims under Article 19 are not allowed where the International Searching Authority has declared, under Article 17(2), that no international search report would be established (see *PCT Applicant's Guide*, Volume I/A, paragraph 296).

What parts of the international application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

When?

Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

How?

Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

What documents must/may accompany the amendments?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 032/04081	FOR FURTHER ACTION		see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/IL2004/001169	International filing date (day/month/year) 26/12/2004	(Earliest) Priority Date (day/month/year) 15/01/2004	
Applicant ALGOTEC SYSTEMS LTD.			

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 5 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ The international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (See Box II).

3. ☒ **Unity of invention is lacking** (see Box III).

4. With regard to the title,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the drawings,

a. the figure of the **drawings** to be published with the abstract is Figure No. 7

☒ as suggested by the applicant.

☐ as selected by this Authority, because the applicant failed to suggest a figure.

☐ as selected by this Authority, because this figure better characterizes the invention.

b. ☐ none of the figures is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IL2004/001169

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G06T7/60

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G06T

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC, IBM-TDB

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>LI R ET AL: "Combining front propagation with shape knowledge for accurate curvilinear modeling"</p> <p>MEDICAL IMAGE COMPUTING AND COMPUTER-ASSISTED INTERVENTION - MICCAI 2003. 6TH INTERNATIONAL CONFERENCE. PROCEEDINGS. PART II (LECTURE NOTES IN COMPUT. SCI. VOL. 2879) SPRINGER - VERLAG BERLIN, GERMANY, 2003, pages 66-74, XP002325788</p> <p>ISBN: 3-540-20464-4</p> <p>the whole document</p> <p>-----</p> <p>-/--</p>	1-72, 86-94



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

28 April 2005

Date of mailing of the international search report

09. 11. 2005

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Herter, J

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IL2004/001169

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>SETHIAN J A: "Level set methods and fast marching methods" [Online] 1999, CAMBRIDGE UNIVERSITY PRESS , XP002325674 Retrieved from the Internet: URL:http://math.berkeley.edu/~sethian/Books/sethian_book.ps> [retrieved on 2005-04-20] the whole document</p>	1-72, 86-94
A	<p>----- DESCHAMPS T ET AL: "Fast extraction of minimal paths in 3D images and applications to virtual endoscopy" MEDICAL IMAGE ANALYSIS, OXFORD UNIVERSITY PRESS, OXFORD, GB, vol. 5, 2001, pages 281-299, XP002904305 ISSN: 1361-8415 the whole document</p>	1-72, 86-94
A	<p>----- COHEN L D ET AL: "GLOBAL MINIMUM FOR ACTIVE CONTOUR MODELS: A MINIMAL PATH APPROACH" INTERNATIONAL JOURNAL OF COMPUTER VISION, KLUWER ACADEMIC PUBLISHERS, NORWELL, US, vol. 24, no. 1, August 1997 (1997-08), pages 57-78, XP000703576 ISSN: 0920-5691 cited in the application the whole document</p>	1-72, 86-94
A	<p>----- WINK O ET AL: "3D MRA CORONARY AXIS DETERMINATION USING A MINIMUM COST PATH APPROACH" MAGNETIC RESONANCE IN MEDICINE, ACADEMIC PRESS, DULUTH, MN, US, vol. 47, no. 6, June 2002 (2002-06), pages 1169-1175, XP001170393 ISSN: 0740-3194 the whole document</p>	1-72, 86-94
A	<p>----- MADDAH MAHNAZ ET AL: "Efficient center-line extraction for quantification of vessels in confocal microscopy images" MEDICAL PHYSICS, AMERICAN INSTITUTE OF PHYSICS, NEW YORK, US, vol. 30, no. 2, February 2003 (2003-02), pages 204-211, XP012011984 ISSN: 0094-2405 the whole document</p> <p>-----</p>	1-72, 86-94

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL2004/001169

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-72, 86-94

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-72,86-94

centerline finding for a tubular tissue in a medical image
data set

2. claims: 73-80

segmentation of an organ in a medical data set

3. claims: 81-85

propagation fo a parametrization in a medical data set

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/IL2004/001169

International filing date (day/month/year)
26.12.2004

Priority date (day/month/year)
15.01.2004

International Patent Classification (IPC) or both national classification and IPC
G06T7/60

Applicant
ALGOTEC SYSTEMS LTD.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:



European Patent Office
D-80298 Munich
Tel. +49 89 2399 - 0 Tx: 523656 epmu d
Fax: +49 89 2399 - 4465

Authorized Officer

Herter, J

Telephone No. +49 89 2399-7478



**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/IL2004/001169

Box No. IV Lack of unity of invention

1. ☒ In response to the invitation (Form PCT/ISA/206) to pay additional fees, the applicant has:
- ☐ paid additional fees.
 - ☐ paid additional fees under protest.
 - ☒ not paid additional fees.
2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rule 13.1, 13.2 and 13.3 is
- ☐ complied with
 - ☒ not complied with for the following reasons:
see separate sheet
4. Consequently, this report has been established in respect of the following parts of the international application:
- ☐ all parts.
 - ☒ the parts relating to claims Nos. 1-72 and 86-95

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-72, 86-94
	No: Claims	
Inventive step (IS)	Yes: Claims	1-72, 86-94
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-72, 86-94
	No: Claims	

2. Citations and explanations

see separate sheet

As to claims 1-72, 86-94 and claims 73-80:

The principal common feature of "segmentation" present in both claims 1 and 73, 77 and 79 is a well-known concept in the art and therefore known to the skilled person. Claim 1 is silent about any special segmentation method and thus the remaining features of said claims which represent the contribution over the known art differ completely thereby leading to a lack of unity (Rule 13 PCT).

As to claims 1-72, 86-94 and claims 81-80:

No common features can be established between said groups of claims, thereby leading to a lack of unity (Rule 13 PCT).

In conclusion, the groups of claims are not linked by common or corresponding special technical features and define 3 different inventions not linked by a single general inventive concept.

The application, hence does not meet the requirements of unity of invention as defined in Rules 13.1 and 13.2 PCT.

3. Item V: Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

- 3.1 The present application meets the requirements of Articles 33(2) and 33(3) PCT because the subject matter of claims 1-72 and 86-94 is novel and involves an inventive step, the reasons being as follows:

As to claim 1:

D1 discloses:

A method of centerline determination for a tubular tissue in a medical image data set defined in a data space (see page 68, lines 1-18), comprising:

- receiving at least one start point and one end point inside a tubular tissue volume (see page 69, lines 8-9);
- automatically determining a path between said points that remains inside said volume (see page 69, lines 9-11);

1. Reference is made to the following documents:

- D1: Li et al.: "Combining front propagation with shape knowledge for accurate curvilinear modelling" Medical Image Computing and Computer-Assisted Intervention - MICCAI 2003. 6th International Conference. Proceedings. Part II (Lecture Notes in Comput. Sci. Vol. 2879) Springer-Verlag Berlin, Germany, 2003, pages 66-74
- D2: Deschamps et al.: "Fast extraction of minimal paths in 3D images and applications to virtual endoscopy" Medical Image Analysis, Oxford University Press, Oxford, GB, vol. 5, 2001, pages 281-299
- D3: Cohen et al.: "Global minimum for active contour models: A minimal path approach" International Journal of Computer Vision, Kluwer Academic Publishers, Norwell, US, vol. 24, no. 1, August 1997, pages 57-78
- D4: Wink et al.: "3D MRA coronary axis determination using a minimum cost path approach" Magnetic Resonance in Medicine, Academic Press, Duluth, MN, US, vol. 47, no. 6, June 2002, pages 1169-1175
- D5: Maddah et al.: "Efficient center-line extraction for quantification of vessels in confocal microscopy images" Medical Physics, American Institute of Physics, New York, US, vol. 30, no. 2, February 2003, pages 204-211

2. **Item IV: Lack of unity of invention**

This Authority considers that there are 3 inventions covered by the claims indicated as follows:

- I: Claims 1-72 and 86-94 directed to centerline finding for a tubular tissue in a medical data set.
- II: Claims 73-80 directed to segmentation of an organ in a medical data set
- III: Claims 81-85 directed to propagation of a parametrization in a medical data set

The reasons for which the inventions are not so linked as to form a single general inventive concept, as required by Rule 13.1 PCT, are as follows:

As to claims 1-72, 86-94 and claims 73-80:

The principal common feature of "segmentation" present in both claims 1 and 73, 77 and 79 is a well-known concept in the art and therefore known to the skilled person. Claim 1 is silent about any special segmentation method and thus the remaining features of said claims which represent the contribution over the known art differ completely thereby leading to a lack of unity (Rule 13 PCT).

As to claims 1-72, 86-94 and claims 81-80:

No common features can be established between said groups of claims, thereby leading to a lack of unity (Rule 13 PCT).

In conclusion, the groups of claims are not linked by common or corresponding special technical features and define 3 different inventions not linked by a single general inventive concept.

The application, hence does not meet the requirements of unity of invention as defined in Rules 13.1 and 13.2 PCT.

3. Item V: Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

- 3.1 The present application meets the requirements of Articles 33(2) and 33(3) PCT because the subject matter of claims 1-72 and 86-94 is novel and involves an inventive step, the reasons being as follows:

As to claim 1:

D1 discloses:

A method of centerline determination for a tubular tissue in a medical image data set defined in a data space (see page 68, lines 1-18), comprising:

- receiving at least one start point and one end point inside a tubular tissue volume (see page 69, lines 8-9);
- automatically determining a path between said points that remains inside said volume (see page 69, lines 9-11);

- automatically segmenting said tubular tissue using said path (see page 69, lines 9-11 and page 70, line 17- page 71, line 5); and
- automatically determining a centerline for said tubular tissue from said segmentation (see page 70, line 17- page 71, line 5)

D1 however does not disclose:

- wherein said receiving, said determining a path and said segmenting, said determining a centerline are all performed on a same data space of said medical image data set.

The method of D1 computes a distance field, so that the operations do not take place within the same data space of medical image data set.

This is also not disclosed in any of the other available prior art on file.

- 3.2 The same reasoning applies, mutatis mutandis, to the subject-matter of the corresponding independent claim 86, which therefore is also considered new and inventive.
- 3.3 The independent claims are not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art (document D1) being placed in the preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).
- 3.4 The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).
- 3.5 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1 to D5 is not mentioned in the description, nor are these documents identified therein.